

and "In the High Heavens," three works by Sir R. S. Ball, F.R.S.; "Astronomy for Everybody," by Prof. S. Newcomb, with an introduction by Sir R. S. Ball; "By Land and Sky, the Record of a Balloonist," by Rev. J. M. Bacon; "Minute Marvels of Nature," by J. J. Ward; and "Peeps into Nature's Ways," by J. J. Ward.

Messrs. G. P. Putnam's Sons' list contains:—"The Family, an Ethnographical and Historical Outline, with Descriptive Notes, planned as a Text-book for the Use of College Lecturers and Directors of Home-reading Clubs," by Dr. E. L. Parsons; "Hunting Big Game with Gun and with Kodak: how Wild Animals Look and Live in their Haunts, from Personal Experiences in the United States, Dominion of Canada, and Old Mexico," by W. S. Thomas, illustrated; "On the Great American Plateau, Wanderings among Canyons and Buttes in the Land of the Cliff Dweller, and the Indian of To-day," by T. M. Prudden, illustrated; "Diagnosis of Organic Nervous Diseases," by Dr. C. A. Herter, revised by Dr. L. P. Clark, illustrated; "The Sporting Rifle," by W. Winans, illustrated; "Scientific Sanction for the Use of Alcohol," by Dr. J. Starke; "The Muscles of the Eye," by Dr. L. Howe, 2 vols.; "Philosophical Problems in the Light of Vital Organisation," by E. Montgomery; and a new edition of "A Manual of Prescription Writing, with a Full Explanation of the Methods of Correctly Writing Prescriptions, and Rules for avoiding Incompatibilities and for Combining Medicines," by Dr. M. D. Mann.

Messrs. Alston Rivers, Ltd., promise:—"Ten Years of Locomotive Progress, with an Introduction upon Modern Railway Policy and Practice," by G. Montagu.

Messrs. Scott, Greenwood and Son give notice of:—"Industrial Alcohol, a Practical Manual on the Production and Use of Alcohol for Industrial Purposes," by J. G. McIntosh; "Modern Flax, Hemp, and Jute Spinning," by H. R. Carter; "Celluloid, the Raw Material, Manufacture, and Uses," by Dr. F. Böckmann; "Paper Testing," by Dr. H. P. Stevens; "The Preparation of Paper for Special Purposes," by L. E. Andrés; "Pottery Decorating," by R. Hainbach; "Grammar of Textile Design," by H. Nisbet; and new editions of "The Practical Compounding of Oils, Tallow, and Grease for Lubrication"; "A Manual of Agricultural Chemistry," by H. Ingle; "Cotton Spinning, for Honours Students," by T. Thornley; "Workshop Wrinkles," by W. N. Brown; "Recipes for Flint-glass Making."

Messrs. Smith, Elder and Co. give notice of:—"Animal Life," by Dr. F. W. Gamble, illustrated; and "The South Polar Times," reproduced in facsimile, the periodical brought out by the officers of the National Antarctic Expedition on board the *Discovery* during the Antarctic winters of 1902 and 1903, illustrated.

Messrs. Swan Sonnenschein and Co., Ltd., direct attention to:—"How to Study Geology," by E. Evans; and a new edition of "Life by the Sea-shore, an Introduction to Natural History," by Dr. M. Newbigin.

Messrs. E. and F. N. Spon, Ltd., announce:—"The Smith and Foreman's Handbook of Practical Smithing and Forging," by T. Moore; "English Weights, and their Equivalents in Kilogrammes," by F. W. A. Logan; "The Stoker's Catechism," by W. J. Connor; "A Treatise on the Grouping of Electric Cells," by W. F. Dunton; "Experimenting with Induction Coils," by H. S. Norrie; "Mechanical Draft, a Practical Handbook for Engineers and Draftsmen," by J. H. Kenealy; "Types and Details of Bridge Construction," by F. W. Skinner, part ii., "Plate Girders"; "Designs for Small Dynamos and Motors," by C. P. Poole; and new editions of "A Treatise on Surveying," compiled by R. E. Middleton, O. Chadwick, and J. Du T. Bogle, part ii.; and "The Management of Electrical Machinery," by F. B. Crocker and Dr. S. S. Wheeler.

Mr. Edward Stanford announces:—Vol. i. of "Australasia" in Stanford's "Compendium of Geography and Travel," by Prof. J. W. Gregory, F.R.S., illustrated.

Mr. Elliot Stock promises:—"Natural History of the British Butterflies," by J. W. Tutt, vol. i., illustrated.

The University Tutorial Press, Ltd., will issue:—"Plant Biology," by Dr. F. Cavers; and a new edition

of "Physiography," by Drs. R. W. Stewart and W. Briggs.

Mr. Fisher Unwin's list contains:—"Woodlanders and Field Folk," by J. Watson; "The Birds of Middlesex," by J. E. Harting, illustrated; "The Psychology and Training of the Horse," by Count E. M. Cesaresco; "The Principles and Practice of X-Ray Diagnosis and Therapy," by Dr. J. Rudis-Jicinsky, with the collaboration of C. H. Treadwell and Dr. J. Hoffman, illustrated; and "The Horse, a Pictorial Guide to its Anatomy," 110 drawings (reproduced by photolithography) by H. Dittich, with explanatory notes by Profs. Ellenberger and Baum.

Messrs. Watts and Co. announce:—"An Essay Outline of Evolution," by D. Hird.

The following are Messrs. Whittaker and Co.'s announcements:—"Modern Practice of Coal Mining," by D. Burns and G. L. Kerr; "Armature Construction," by H. M. Hobart and A. G. Ellis; "Electricity in Mining," by P. R. Allen; "Electric Lamps and Photometry," by L. Gaster; "Motor-car Construction," by T. Gray; "The Care of Motor Cars," by T. Gray; and "An Advanced Text-book of Steam, Gas, and Oil Engines," by J. W. Hayward.

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The master and fellows of University College have established a "Radcliffe prize" for the encouragement of research in medical science; it will be awarded every second year alternately with the Rolleston prize. Its value is 50*l.*, and it is open to all graduates who have not exceeded twelve years from the date of passing the last examination for the degree of Bachelor of Arts, and are not Radcliffe fellows at the date of application. Candidates must send in their memoirs to the secretary to the boards of faculties on or before June 1.

CAMBRIDGE.—The Master of Trinity Hall has consented to act, and will be formally appointed to act, as deputy for the Vice-Chancellor for the period from March 22 to April 24, when the Vice-Chancellor will be absent in America representing the University at the opening of the Carnegie Institute.

The subject selected for the Adams prize in 1908 is "The Radiation from Electric Systems or Ions in accelerated Motion and the Mechanical Reactions on their Motion which arise from it." The prize is open to the competition of all persons who have at any time been admitted to a degree in this University. The essays must be sent in to the Vice-Chancellor on or before December 16, 1908, privately. The successful candidate will receive about 225*l.*

A university lecturer in pathology will shortly be appointed. The stipend is 100*l.* per annum. Candidates are requested to send their names and testimonials to the Vice-Chancellor on or before April 19.

The next combined examination for sixty-six entrance scholarships and various exhibitions at Pembroke, Gonville and Caius, King's, Jesus, Christ's, St. John's, and Emmanuel Colleges will be held on December 3 and following days. Mathematics and natural sciences will be the subjects of examination at all the above-mentioned colleges. A candidate for a scholarship or exhibition at any of the seven colleges must not be more than nineteen years of age on October 1, 1907. Forms of application for admission to the examination at the respective colleges, and further information respecting the scholarships, may be obtained as follows:—Pembroke College, Mr. W. S. Hadley; Gonville and Caius College, the Master; King's College, Mr. W. H. Macaulay; Jesus College, Mr. A. Gray; Christ's College, Rev. J. W. Cartmell; St. John's College, Dr. J. R. Tanner; Emmanuel College, the Master.

DR. H. T. BARNES, assistant professor of physics in McGill University, Montreal, has been appointed professor of experimental physics in succession to Prof. E. Rutherford, F.R.S.

THE sixth annual students' soir  e of the Sir John Cass Technical Institute will be held on Saturday, March 16. The programme includes special demonstrations and short addresses on scientific subjects in the laboratories and workshops of the institute.

ON April 23, the University of Glasgow will confer the honorary degree of Doctor of Laws upon Sir George Watt, author of the "Dictionary of the Economic Products of India"; Prof. E. Boutroux, Paris; Prof. J. Norman Collie, F.R.S.; Prof. U. Dini, Pisa; Prof. J. H. Poincar  , Paris; Prof. John G. McKendrick, F.R.S.; and Principal D. Macalister.

THE estimated expenditure on education, science and art, for the year ending March 31, 1908, is given in the Civil Service Estimates, recently issued, as 17,495,237*l.*, which is a net increase of 316,955*l.* upon the grants made in the fiscal year just ending. The following extracts show how some of the estimates compare with the grants made in the preceding year:—

	1907-8		Compared with 1906-7	
	£		£	
Board of Education ...	13,593,646 ...		254,046 ...	—
British Museum ...	171,041 ...		1,043 ...	—
Scientific Investigation, &c. ...	54,479 ...		— ...	3,171
Universities and Col- leges, Great Britain, and Intermediate Education, Wales ...	201,400 ...		1,000 ...	—
Public Education (Scot- land) ...	2,022,554 ...		50,426 ...	—
Public Education (Ire- land) ...	1,408,360 ...		15,137 ...	—
Queen's Colleges (Ire- land) ...	4,700 ...		— ...	161

The apparent decrease in the estimate under scientific investigation is explained by the fact that in 1906-7 the grant to the National Physical Laboratory for new buildings and equipment was 10,000*l.*, instead of the 5000*l.* to be granted to the laboratory in 1907-8.

THE executive committee has submitted to the trustees of the Carnegie trust for the universities of Scotland its sixth annual report, which is concerned with the administration of the trust during the year 1906. Under the scheme of allocation for five years of an annual grant of 40,000*l.* among the four Scottish universities, which became operative on January 1, 1903, sums of 37,289*l.* were claimed and paid during 1906. The grants for library purposes and for provisional assistance in teaching amounted for the year to 6400*l.* For buildings and permanent equipment the grants for 1906 reached 26,189*l.* Payments towards teaching endowments to the extent of 4700*l.* were made, and there is under this head an unexpended balance of 25,132*l.* Under the scheme of endowment of post-graduate study and research, appointments were made to seventeen fellowships and to thirty-seven scholarships. Grants of varying amounts were in addition paid to forty applicants. The total expenditure under this scheme was 6303*l.* during 1906, and it is estimated that during 1907 8064*l.* will be spent. The expenditure upon the Royal College of Physicians laboratory during the year was, so far as the trust is concerned, 314*l.*—this amount being independent of the capital invested in taking over the property of the laboratory buildings. The report directs attention to modifications in the scheme of payment of class fees adopted last year by the committee; the first limited payment of fees of further classes to those beneficiaries who had passed their graduation examinations up to date, and the second modification limited payment of fees of advanced classes to those who had proved their ability to profit by such classes. A striking diminution in the number of beneficiaries and in expenditure upon class fees followed the adoption of these modifications. The report is provided with extensive appendices, which supply detailed information concerning the numerous activities of the trust.

NO. 1950, VOL. 75]

## SOCIETIES AND ACADEMIES.

### LONDON.

**Royal Society, December 13, 1906.**—"The Velocity of the Negative Ions in Flames." By Ernest Gold. Communicated by Prof. H. A. Wilson, F.R.S.

The experiments described in this paper may be regarded as a continuation of the investigations of the properties of ions in flames carried out by Prof. H. A. Wilson in this country and by Marx and Moreau on the Continent.

The determinations of the velocity of the negative ions previously made had led to the conclusion that the ions were of the nature of corpuscles loaded with electrically neutral molecules. The present series of experiments shows that this is not the case, but that the ions are probably free electrons.

The first part of the paper gives an account of experiments made with platinum disc electrodes immersed in a flame obtained by burning the gas from a large Bunsen burner at a row of holes in a quartz tube (quartz for insulation). It is shown that the conductivity of the flame is unaffected by putting salt on the electrodes, although the current is increased from  $7.3 \times 10^{-6}$  to  $261 \times 10^{-6}$  ampere, a result which enables the gradient to be determined from the current.

The value of the conductivity obtained and the number of ions per c.c. deduced from experiments by Prof. Wilson and the author (*Phil. Mag.*, April, 1906) enable an approximate value to be found for the velocity of the negative ions in an electric field. The velocity so obtained, 8000 cm. per second for an intensity of one volt per cm., was of a different order from those previously obtained (1000 cm. per sec.).

The latter had been found on the assumption that for small potential differences between platinum electrodes the gradient in the flame was uniform from electrode to electrode, the very close way in which Ohm's law was followed for small applied E.M.F.'s serving as a foundation for the assumption. The measurement of the gradient for applied E.M.F.'s of the order of one volt across 5 cm. is complicated by the variations in the potential taken up by a platinum wire in the flame, due to changes in the temperature and ionisation. These changes are large compared with the quantities to be measured, and ordinary methods of deducing corrections leave possible errors of the same order as the corrected quantity. To avoid this difficulty a special arrangement was adopted in which, by using a thermocouple as explorer, the actual variations due to the applied E.M.F.'s were separated from the incidental variations in the flame. It was found in this way that the fall of potential consisted of a rapid drop at the electrodes, at the negative electrode for the free flame, and at the positive when salt was vaporised beneath the kathode, together with a uniform gradient in the body of the flame.

The results so obtained gave the gradient necessary to drive the ions of salt vapour from the kathode to the anode while they travelled upwards with the stream of gas.

If  $v$  is the upward velocity of the flame gases,  $h$  the height of the electrodes,  $d$  the distance between them, and  $x$  the distance the salt vapour extends from the kathode, the velocity  $k_e$  of the negative ions for unit electric field is given by  $k_e X/d - x = v/h$ , where  $X$  is the gradient found as above. The velocity  $v$  of the flame gases was found by photographing the images of bright particles in the flame formed by reflection at a plane mirror attached to an electrically-driven tuning-fork.

The value found for the velocity of the negative ions for a gradient of one volt per cm. was found to be 12,900 cm. per sec.

The velocity of a corpuscle of mass  $m$  and charge  $e$  in an electric field of intensity  $X$  is  $Xe\lambda/\mu u$ , where  $\lambda$  is the mean free path and  $u$  the mean velocity of agitation of the corpuscles. Taking for  $e/m$ ,  $\lambda$ ,  $u$ , the values  $10^7$ ,  $3 \times 10^{-4}$ ,  $2.32 \times 10^7$ , respectively, we get for a field of one volt per cm. a value 13,000 cm. per sec. nearly, a result in close agreement with the value for the velocity of the ions found experimentally. It appears, therefore, that the